California Energy Commission's Water - Energy Programs

An Overview of Utilizing WWTP Digester Gas for Power Generation in California

Overseas Investigation Tour by the Japanese Gas Association

Shahid Chaudhry

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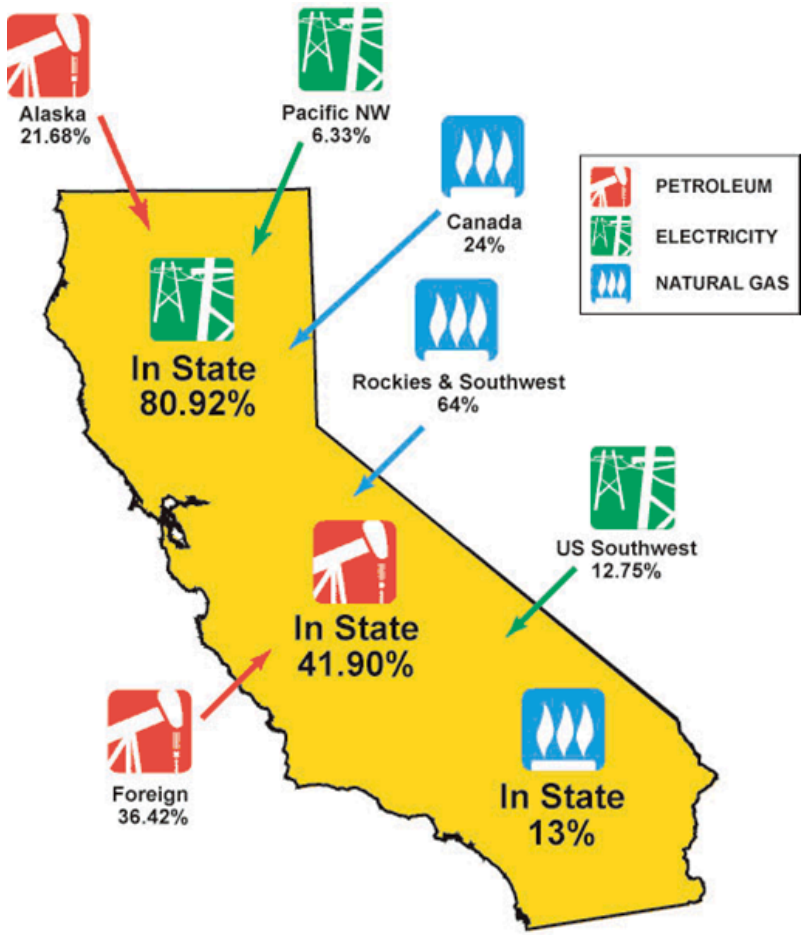
- **California Energy Commission**

CA's Energy Policy and Planning Agency

- Historical Energy Data/Forecast Future Energy Needs
- License Power Plants
- Advance Energy Technologies
- Promote Energy Efficiency/Conservation
- Plan for State Response to Energy Emergency

• Energy Sources in California



- **Electricity Sources in California (2004)**

In-State ***80.92%***

Natural Gas	***41.9%***
Nuclear	***12.9%***
Hydro	***14.8%***
Coal	***19.8%***
Renewable	***10.6%***

Imports ***19.08%***

PNW	***6.33%***
DSW	***12.75%***

California's Renewable Portfolio Standard Requires:

20% of Retail Electricity Sales from Renewable Sources by 2017

- **Electricity From Renewable Sources in California – 2004 (100% in-state)**

Biomass*	5,997 GWh	2.2%
Geothermal	13,571	4.9%
Small Hydro	4,669	1.7%
Solar	743	0.3%
Wind	4,258	1.5%
Total Renewables	29,238 GWh	10.6%

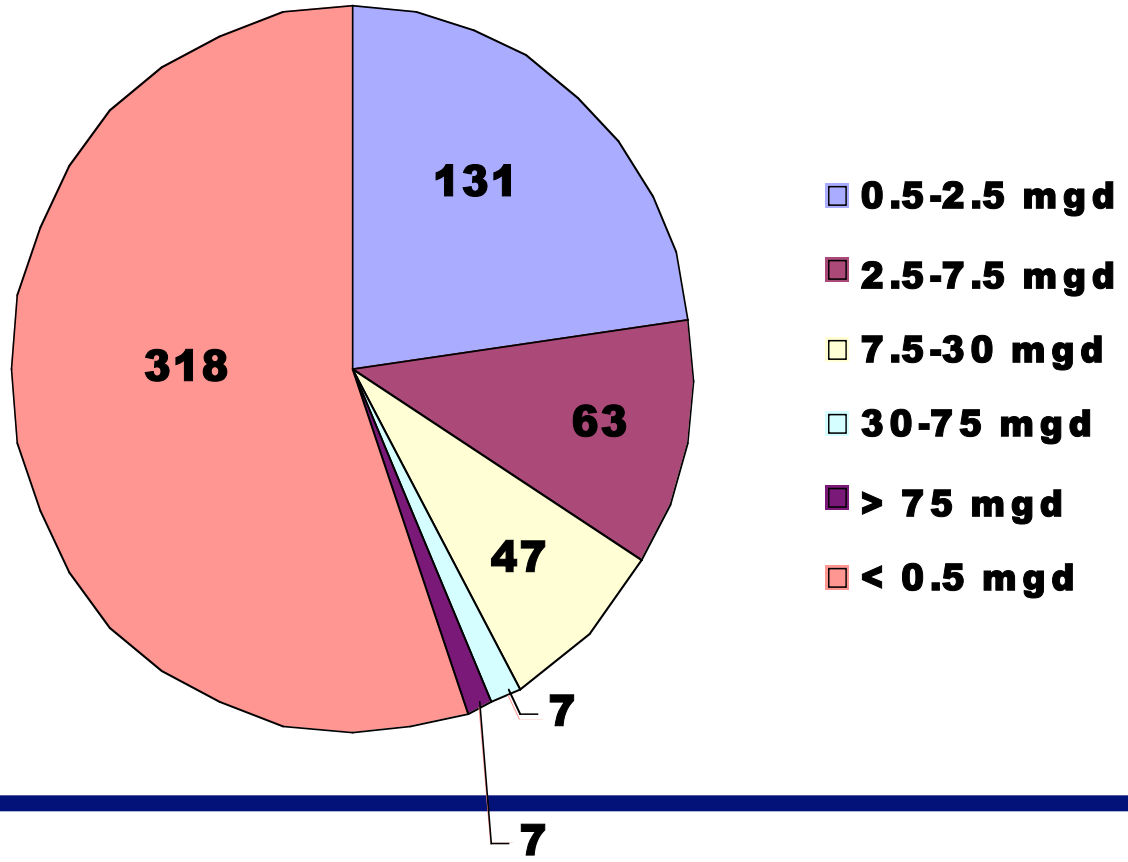
* Includes Agricultural, Forestry, and Municipal Biomass

- **WWT Plants in the U.S.**

(Analyzed by ICF Consulting Using EPA Data, 2004)

No. of WWT Plants	**16,029**
% of Plants with Anaerobic Digestion Treatment	**19%**
% of Plants with Digester Gas Utilization	**1%**
Total Reported Flow	**30,275 mgd**
% of Flow with Anaerobic Digestion Treatment	**52%**
% of Flow with Digester Gas Utilization	**15%**

- **WWT Plants in California**
  (Total 573 – U.S. EPA 2004 Database)



- **Estimated Electricity Generation Potential from Digester Gas in California**
  (WWT Plants / Landfill Gas / Animal Manure)

Total Gross Potential	**1,796 MW**	**13,373 GWh**
Total Technical Potential	**967 MW**	**7,195 GWh**
Existing Generation	**300 MW**	**2,224 GWh**
Near Term Planned Generation	**25 MW**	**196 GWh**
Remaining Technical Generation Potential	**642 MW**	**4,775 GWh**

- **Estimated Electricity Generation Potential from WWTP Digester Gas in California**

Biogas Available from WWTP **(Containing 60% CH_4)**

Gross	**16 Billion ft^3/yr**
Technically Useable	**11 Billion ft^3/yr**

23 Existing WWT Plants to Electricity ~ 40 MW

(Range 50 kW -- 15 MW; 18 sites < 2 MW; 5 sites > 2 MW)

WWT Plants w/o Energy Recovery Operations

222 plants	**37 MW Potential**
2 plants	**> 1 MW**
50 plants from	**200 kW - 1 MW**
170 plants	**< 200 kW**

Existing WWT Plants Producing Electricity

Existing WWT Plants w/o Energy Recovery Operations

- **Cost of Electricity from Digester Gas**

Relatively Expensive than Geothermal, Wind, and Combine Cycle Power Plants

Typical Costs for New Biogas Installations

(Depending on Fuel Costs)

$1,500 -- $3,000 / kW

$0.05 -- $0.07 / kWh

WWTP Digester Gas Usually Used with Internal Combustion Reciprocating Engines @ $2,000 -- $5,000 / kW

Benefits of Using

WWTP Digester Gas in California

Gross Potential Capacity **~ 116 MW**

Technically Feasible **~ 78 MW ; ~ 578 GWh**

Reduced Groundwater Pollution

Lowered Methane Emissions

Reduced NOx Emissions

- **Potential Barriers**

  Quality of Digester Gas / Pretreatment Issues
  Cost of Conversion
  Lack of Stable Long Term Incentives
  Permitting Issues
  Uncertainties in Equipment Performance
  Limited Availability of Skilled Force

- **Examples of Using WWTP Digester Gas**

City of Merced

Refurbished IC Cogeneration System, 325 kW @ $369 / kW

City of San Mateo

Refurbished IC Cogeneration System, 500 kW @ $1,048 / kW

City of San Diego

Converted Diesel Generators to Diesel & Digester Gas 1,200 kW @ $262 / kW

North San Mateo County

Installed Six 30-kW Micro-turbines @ $3,015 / kW

Big Bear Area Regional Wastewater Agency

Replaced Diesel Generator with Gas IC Generator, 600 kW @ $1,070 / kW

City of Benicia

Replaced Diesel Generator with Gas IC Generator, 1,000 kW at $1,094 / kW

- **For More Information on**
  California Energy Commission's
  Water-Energy Programs

Shahid Chaudhry 916-654-4858

schaudhr@energy.state.ca.us